Patent Claims

1. A process for producing an inorganic-inorganic composite material for use in the dental sector, in which
   - after shape-imparting processing and presintering of a powder containing oxide ceramic, an open-pore, crystalline oxide ceramic shaped part is produced,
   - an infiltration substance, which consists of a precursor of a nonmetallic-inorganic phase, or an amorphous glass phase and a solvent, or of a hydrolysable compound of a metal, or contains an alkoxide of a metal, or a precursor of a silicate glass, in particular a hydrolysable silane, is applied to this shaped part at room temperature,
   - the penetration of the infiltration substance into the oxide ceramic body is carried out during an infiltration time of less than 10 minutes, and
   - under an air atmosphere and at ambient pressure, the oxide ceramic is sintered in a densifying manner, to a theoretical density of at least 99.5%, at a temperature of from 1000°C to 1600°C to form the inorganic-inorganic composite material.

2. The process as claimed in one of the preceding claims, characterized in that for the shape-imparting processing the powder containing oxide ceramic is provided with an organic binder and pressed.

3. The process as claimed in one of the preceding claims, characterized in that the organic binder is an ethylenic wax material, in particular an ethylenic wax, a polyvinyl resin, a polyvinyl

pyrrolidone, polyvinyl acetate, a polyvinyl butyral and/or cellulose.

4. The process as claimed in one of the preceding claims, characterized in that the presintering takes place at a temperature of from 600 to 1300°C.

5. The process as claimed in one of the preceding claims, characterized in that the infiltration substance is applied in vacuo.

6. The process as claimed in one of the preceding claims, characterized in that penetration takes place at less than 40 mbar.

7. The process as claimed in claim 4, characterized in that penetration takes place at 10 to 30 mbar.

8. The process as claimed in one of the preceding claims, characterized in that the infiltration substance is applied in a layer thickness of from 2 to 90% of the thickness of the presintered open-pore crystalline oxide ceramic.

9. The process as claimed in claim 8, characterized in that the layer thickness of the infiltration substance amounts to 2 to 30% of the thickness of the dense-sintered inorganic-inorganic composite material.

10. The process as claimed in claim 9, characterized in that the layer thickness amounts to 5 to 20%.

11. The process as claimed in one of the preceding claims, characterized in that for the dense-sintering the infiltration substance is applied in a layer thickness of 5 - 90% of the

thickness of the presintered oxide ceramic shaped part.

12. The process as claimed in claim 11, characterized in that it is applied in a layer thickness of from 10 to 90%.

13. The process as claimed in one of the preceding claims, characterized in that the infiltration substance is applied in the presence of a solvent.

14. The process as claimed in claim 13, characterized in that a polar or nonpolar solvent is used.

15. The process as claimed in claim 13 or 14, characterized in that the solvent used is water or alcohol.

16. The process as claimed in one of the preceding claims, characterized in that further external shaping of the composite material by material-removing machining takes place prior to the infiltration.

17. The process as claimed in one of the preceding claims, characterized in that the external shaping of the composite material by material-removing machining and/or etching takes place after the infiltration or after the full sintering, which takes place in particular at ambient pressure.

18. The process as claimed in one of the preceding claims, characterized in that an adhesive agent is applied to at least sections of the surface of the composite material, and/or a further material is attached.

19. The process as claimed in one of the preceding claims, characterized in that an at least one-layer coating is applied at least to sections of the surface of the composite material and is subjected to a further heat treatment in particular after it has been applied.

20. The process as claimed in one of the preceding claims, characterized in that following the partial sintering of the composite material with an oversize of 10 to 50%, a material-removing machining operation is carried out for the imparting of the shape.

21. The process as claimed in claim 19, characterized in that the material-removing machining is carried out with an oversize of from 15 to 30%.

22. The process as claimed in one of the preceding claims, characterized in that the powder containing oxide ceramic is processed to form an open-pore oxide ceramic shaped part in the form of a monolithic block or cylinder.

23. The process as claimed in claim 22, characterized in that the monolithic block or cylinder undergoes chip-forming machining.

24. The process as claimed in claim 23, characterized in that after the chip-forming machining the infiltration substance is applied in vacuo.

25. An inorganic-inorganic composite material, characterized in that it has a translucent inner region made from a crystalline oxide ceramic and a layer of an infiltration substance which at least partially surrounds or covers the inner region which contains the precursor of a

nonmetallic-inorganic phase or of an amorphous glass phase or of a hydrolysable compound of a metal or of an alkoxide of a metal selected from the group of elements consisting of Al, Ti, Zr or Si or contains a hydrolysable silane, and has a theoretical density of >99.5% and a biaxial strength of not less than 800 MPa and a fracture toughness of more than 6.5 MPa $m^{1/2}$.

26. The composite material as claimed in one of the preceding claims, characterized in that the open-pore, crystalline oxide ceramic contains zirconium oxide and additions of yttrium oxide.

27. The composite material as claimed in one of the preceding claims, characterized in that the zirconium oxide contains additions of from 2 to 4 mol%, in particular in the range from 2 to 10 mol% of yttrium oxide or of 2.5 to 15 mol% of cerium oxide or 2.5 to 5 mol% of erbium oxide or 2.5 to 5 mol% of scandium oxide or of 0.1 to 15 mol% of titanium dioxide or mixtures of two or more of the abovementioned oxides in the quantities indicated.

28. The composite material as claimed in claim 26, characterized in that the zirconium oxide contains additions of from 2 to 4 mol% of yttrium oxide.

29. The composite material as claimed in one of the preceding claims, characterized in that the open-pore, crystalline oxide ceramic contains aluminum oxide and mixtures of further metal oxides and/or zirconium oxide, preferably tetragonal zirconium oxide.

30. The composite material as claimed in claim 25, characterized in that the precursor of the non-metallic-inorganic phase contains ionogenic or

covalent compounds of the elements of groups Ia, IIa, IIIa, IVa, IIIb, IVb, Vb, VIb, VIIb, VIIIb, where a denotes the main groups and b the transition groups of the periodic system of the elements.

31. The composite material as claimed in claim 25, characterized in that the infiltration substance contains covalent bonds of Si and/or Zr.

32. The composite material as claimed in claim 25, characterized in that the infiltration substance contains ionogenic compounds, preferably Ce, Mn, V, Fe or mixtures of said elements.

33. The composite material as claimed in claim 25, characterized in that the amorphous glass phase is silicate glass, preferably an alkali-metal-free silicate glass.

34. The composite material as claimed in claim 25, characterized in that the infiltration substance contains tetraethyl orthosilicate as hydrolysable compound.

35. The composite material as claimed in claim 25, characterized in that the infiltration substance contains alkoxides of silicon or aluminum.

36. The composite material as claimed in one of the preceding claims, characterized in that the inner region is translucent and the layer of infiltration substance is cloudy-white.

37. The composite material as claimed in one of the preceding claims, characterized in that the inner region has a translucency which corresponds to

that of hot isostatically pressed sintered ceramics.

38. The use of the crystalline, open-pore oxide ceramic and of the inorganic-inorganic composite material produced therefrom as claimed in one of claims 20 to 36 in the dental sector, preferably as a dental restoration, implant, implant part or orthodontic product.

39. The use as claimed in claim 38, characterized in that the dental restoration is a dental framework, a crown, a partial crown, a bridge, a cap, a shell, a veneer, an abutment or a post structure.